5.0 Accident Analysis

The Proposed Action is the implementation of a corrective measure at MDA H. All of the corrective measure options are centered around either containment of or excavation and complete removal of the waste inventory at MDA H. NEPA guidance recommends the use of a sliding-scale approach for considering, analyzing, and reporting accidents that might occur for a Proposed Action (DOE 2002). As such, only the risk-dominant accidents for the excavation and removal corrective measure options were chosen to represent the spectrum of postulated accidents considered and analyzed for the Proposed Action and discussed in this chapter. A discussion of a full spectrum of accidents analyzed for the excavation alternatives can be found in a report by Omicron (Omicron 2001). A risk assessment on potential worker and public risks from postulated accidents has concluded that accidents involving exposure of the public to radioactive or hazardous materials left in place at MDA H are not credible[31] (Omicron 2001). Excavation and removal corrective measure options including associated transportation pose the greatest risk to members of the public, albeit a small one. The risk to the public from all other activities is negligible. The risk to workers is dominated by standard industrial accidents and explosions and is most associated with site excavation activities.

Radioactive wastes were disposed of in MDA H from May 1960 through August 1986. The majority of the waste is DU (about 24 percent) and other radioactive material (an additional 24 percent). DU is almost 60 percent less radioactive than natural uranium and the potential chemical effects of DU can be of more concern than the radioactive effects. About 4,800 lbs (2,160 kg) of HE were disposed of in a single shaft and 47,000 lbs (21,150 kg) of HE-contaminated material (containing less than 1 percent HE) was disposed of throughout the nine shafts.

Slightly more than 150 potential accident scenarios have been postulated for the proposed MDA H corrective measure options. Process hazard analyses were performed on postulated accidents that failed to be screened out based on the likelihood of their occurrence and their potential effect on human health. Unmitigated and mitigated public, worker, and transportation risks associated with excavating MDA H have been assessed. The corrective measure activities assessed included site preparation; site excavation; sorting and segregation of waste; declassification, packing, and loading of waste; waste transportation; and site restoration. The spectrum of hazards considered included industrial hazards, fires, explosions, spills, and penetrating radiation.

5.1 Risk to the Public

Excavation of the waste would pose more threat to human health from accidents than containment of the waste; however, even excavation is relatively safe because it is not an extraordinary action for LANL workers. The relatively small quantity of potentially dispersible radioactive or hazardous material expected to be present in the shafts would minimize the risk of exposure to members of the public. Many accidents were postulated in which exposure to radiological material was the accident type, but all of these scenarios resulted in no or negligible dose consequences to members of the public (Omnicron 2001). The quantities of dispersible

[31] Credible means having a chance of occurrence of one in one million.

radiological and hazardous materials estimated to date to be present within MDA H and the resultant consequences from accidental exposure scenarios are too low to warrant quantitative consequence analysis. Potential human health impact from chronic (non-accident) exposures was addressed in the CMS Report (LANL 2003) and is summarized in Section 4.5 of this EA.

Regarding industrial accidents and the public, of 33 hazards (most with two or more initiating events) analyzed for the project, only an offsite transportation accident posed a credible threat to the public and the most serious effects were death or serious injury from the physical forces of the accident; thus a common industrial accident. Using current DOT statistics and an estimated maximum total number of miles of truck travel to move MDA H waste offsite, no (1.13×10^{-3} persons per year or about once every 900 years) member of the public would likely be killed from this activity for the duration of the project (Omicron 2001). Likewise, no (2.03×10^{-2} persons per year or about once every 50 years) member of the public would likely be seriously injured from this activity over the duration of the project.

5.2 Worker Risks

Most of the worker accident scenarios of relatively high-risk (likelihood multiplied by consequence) categories were standard industrial accidents that are common across the U.S. More than 30 standard industrial accidents that could result in severe worker injuries were identified. Most of these accidents were vehicle accidents, explosions, equipment failures, lightning strikes, electrocution, and operator errors.

Explosives are thought to constitute less than 1 percent (4,800 lb [2,160 kg]) of the waste in MDA H. This quantity is enough to be involved in explosion accidents; this was thoroughly evaluated in the risk assessment (Omicron 2001). Numerous postulated unmitigated accidents involving HE and potentially pyrophoric uranium in excavation corrective measure options could result in severe consequences to workers leading to immediate health effects or loss of life. Although the risk could be effectively mitigated through measures that substantially reduce the likelihood of such accidents (such as use of remote manipulators and excavation in an inert atmosphere), the consequences of such accidents could remain severe. Remote handling is a technology that would be used if an excavation corrective measure option were to be selected (LANL 2003); this would substantially reduce the potential adverse consequences to site workers from an accident of this type.

5.3 Containment Corrective Measure Options (1, 2, and 3)

Corrective measure options revolving around containment are safe and relatively free of accident hazards in comparison to the bounding accidents considered for the excavation and removal corrective measure options. Specifically, in the containment corrective measure options, the uranium hydride present in the shafts would be unlikely to result in a fire because the amount of oxygen present is not sufficient to allow the ignition of or sustain a hydride fire. Thus, the formation and presence of hydride in the shafts at MDA H would not pose a fire hazard (LANL 2003). In addition, any postulated accident involving the inhalation of uranium oxide scale would be virtually eliminated if one of the containment corrective measure options were selected.

5.4 Excavation Corrective Measure Options (4 and 5)

Explosion accidents were considered. Explosions caused by corrective measure activities are generally considered to occur with a frequency ranging from once every 100 years to once every 10,000 years. These events can result from the rupture of tanks used to store flammable gas or liquids to support corrective measure activities and could result in severe injuries or fatalities to workers. Explosions resulting in severe injuries or fatalities to workers could also occur if buried HE is impacted during remediation activities. The risk from explosion scenarios would be mitigated by implementing preventative controls, but the mitigated health effects to workers from such scenarios could still be severe. Therefore, risk is still considered to be of concern, and could require formally implementing more controls into procedures and training. The analyses (Omicron 2001) had sufficient scope to adequately represent the health risks associated with many types of explosions that could occur with the excavation corrective measure options. The need for engineering controls has also been identified to address three potential accidents, fire involving pyrophoric uranium hydride, ignition of HE, and inhalation of uranium oxide dust, that were identified in the CMS Report (LANL 2003) as associated with the excavation corrective measure options.

Remote operations for the excavation and removal of waste while in an inert atmosphere would enable the safe conduct of these activities. Standard dust control technologies and the use of personal protective equipment would effectively eliminate the uranium oxide dust hazard.

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